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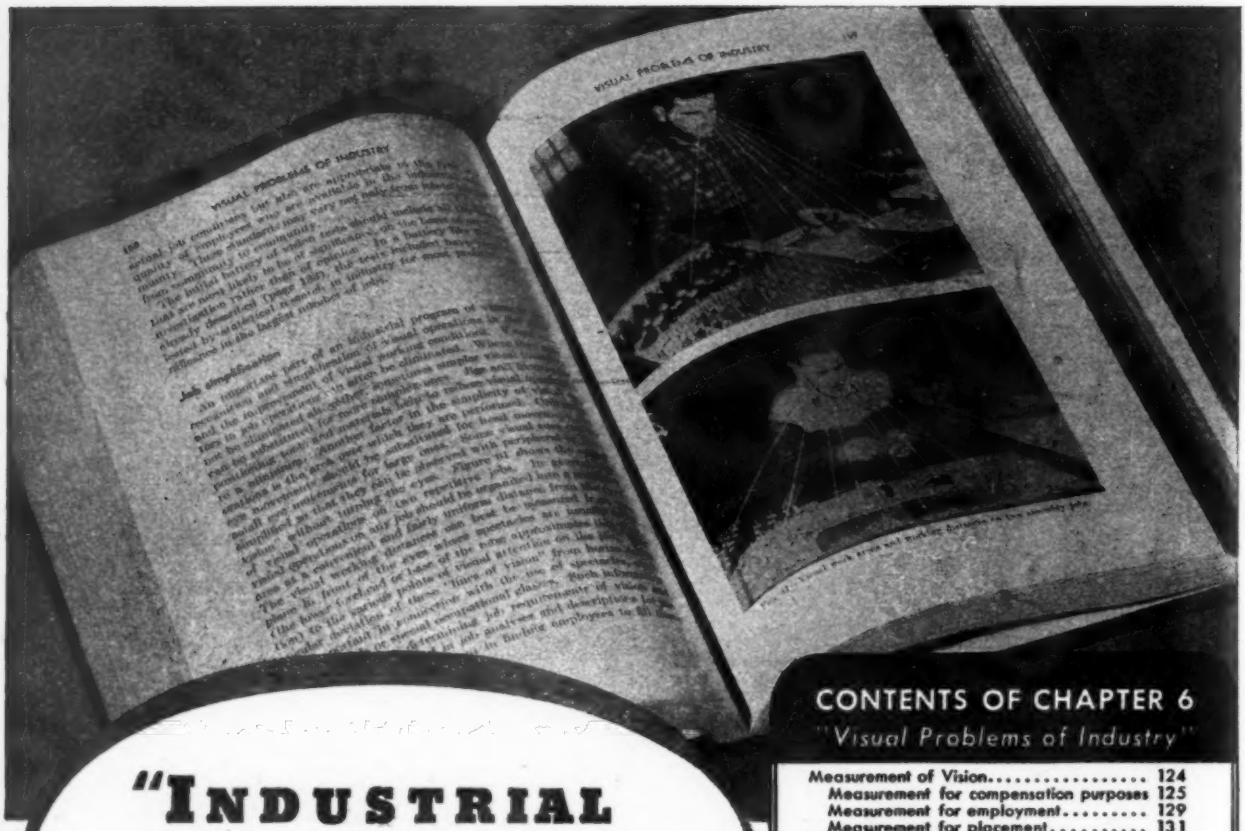

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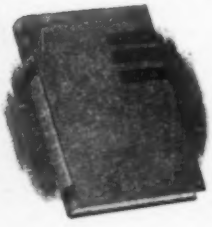

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KINESTHETIC OR RETROFLEX REACTIONS IN REFRACTIVE PROCEDURES*

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Detroit, Mich.

Kinesthetic Images are the revived sensations of muscle co-ordinations. Just as the visual image is the recollection of a visual sensation; as the olfactory image is the revival of an olfactory sensation; as a pain image is a revived sensation of a previously experienced pain; so is the kinesthetic image a revival of the experiences of the central nervous system's previous co-ordinations of muscular reflexes to produce the efficient performance of an act.

Kinesthesis is the associated control of reflexes based on the kinesthetic images of their previously learned associations. Kinesthesis is probably one of the most important matters in optometric practice; but to a large extent is entirely ignored in optometric teachings.

If a group of muscles is used simultaneously with another group, to perform some act in which both must co-ordinate for successful performance of the act, and this act is performed over and over again, hundreds and thousands or millions of times, so it becomes a fixed "habit," there will come a time when if one part of this usually associated act of the two or three or more groups is performed alone by one of the groups, the kinesthetic images of the often performed group activity are revived by the performance of part of the act by the one muscle group, so that other part of the act by the usually associated other group or groups is excited by these kinesthetic images and the other part of the habitual act follows as a kinesthetic reflex.

Troland suggested that this particular phase of associative muscle control be called retroflex as a distinguishing term. We shall hereafter use the term "retroflex" in this paper, in place of "kinesthetic reflex."

*Submitted on February 8, 1943, for publication in the May issue of the American Journal of Optometry and Archives of American Academy of Optometry. An abridgment of the material, pages 46-56, of Clinical Report Number One, Some Points in the Correction of Myopia, published by the Optometric Research Institute of Detroit.

The refractionist who makes phoria and duction tests sees several demonstrations of these retroflexes every day. He can make as many demonstrations as he pleases.

For example: Supposing we find a patient showing, say, 3△ of exophoria. Supposing we put some minus spheres before his eyes and we then find only, say 1△ or 2△ of exophoria. What has happened? Let us go back and work this out. When we change from distance to near vision, what happens? What do we do? Why do we do it?

Assuming the eyes are in focus for distant objects, the optical images of a near object will be focused behind the retinas until we increase the convexity of the crystalline lenses as a reflex to the blur sensation. This reaction is positive accommodation. The muscles which contract are those of positive accommodation.

Still assuming the eyes are adjusted for distant vision, they are so positioned that the retinal images of a distant object are in the foveas of the two eyes. So the retinal images of a near object are at the temporal sides of the two foveas; until one contracts the inturning, or converging muscles so the foveas turn to the retinal images of the near object. This is positive vergence, or "convergence." It is the reflex to the sensation of off-foveal retinal images, if the retinal images are both to the temporal sides of the foveas.

Thus: in changing visual attention from distant to nearer objects, we use two unrelated groups of muscles together for the sake of sharp focus and clear vision. The muscles of positive accommodation and those of positive vergence are simultaneously stimulated to contract; but as independent reflexes, each in reaction to the particular sensation which excites it. The two reflexes occur simultaneously simply because the two exciting sensations are perceived at the same time.

Both acts are essential to efficient visual work at near. Both acts are performed together hundreds of times every day. Thus develops what is called "Association of Accommodation and Convergence."

Now to our experiment. The subject is looking at an object which he sees clearly. The distance is unimportant, so long as he has focused and foveally fixated with both eyes; or even if he is only in approximate focus and fixation. We found, as above noted, 3△ of exophoria at the distance at which the test was made. Then we put minus spheres before his eyes. These set the foci of the optical images to some point behind the retina of each eye. If he makes the effort to see clearly through them, it is

the same reflex as changing focus from distance to near. The muscular reflex is the contraction of the muscles used for positive accommodation which ends in the increased convexity of the crystalline.

Now he is using the muscles of positive accommodation alone, not contracting the muscles of positive vergence. That is contrary to the habit of a lifetime. The proprioceptive sensation of using the one group of muscles revives the images of his habitual uses of the two groups in association, and kinesthetic reflex, or retroflex follows. The muscles of positive convergence contract associatively and the phoria is now less than 3△ exophoria, or in some cases we may discover an actual esophoria with the minus spheres in place. Or, in other cases, we may not find an actual reduction of the exophoria immediately, but if he should wear the minus spheres a few weeks an esophoria might develop. This does happen in some cases where we load too much minus on a myope.

The amount of change of the phoria and the speed of the change of phoria in these experiments varies with different individuals and varies in the same individual at different times.

All recent investigations indicate that such kinesthetic, or as more commonly said, convergence and accommodative, relations are individually acquired; that the nativistic theories of Hering and his school concerning these relations are of questionable validity. Hence, the retroflexes we observe will vary considerably among individuals.

There are some persons who do not show a vergence retroflex, as demonstrated by phoria change if we use minus lenses but will show retroflexes by a phoria change if we use plus lenses; and with some it is the reverse. With others there will be no demonstration at one distance while there will be a demonstration at other distances. Some will not attempt to focus through minus but will attempt to focus through plus and some will attempt neither. Others will attempt and fail in one or both.

Occasionally we meet an individual who will successfully dissociate the two acts, who will adapt himself to either plus or minus or both without showing a retroflex. But these individuals are rare. Almost every one will fail in complete dissociation with some particular lens power or prism power at some special distance if not at all distances. The measured amounts of the retroflex changes vary at different testing distances for most persons.

If the exophoria is increased when we use plus lenses, or if an

orthophoria is changed to exophoria, or if esophoria is reduced or becomes exophoria, what is the process?

Assume a pair of eyes are focused and bifoveally fixated, or approximately so, for clear near vision; and then the attention is changed to a distant object. The two reflexes which take place are: (1) negative accommodation (2) negative vergence. For when the eyes are accommodated and fixated for vision of near objects, the retinal images of distant objects are (1) focused in front of the retinas and (2) fall in areas to the nasal side of the foveas. The reflex to the first is negative accommodation; the reflex to the second is negative vergence.

The two sensations are perceived simultaneously. The two reflexes occur simultaneously. In time, by millions of repetitions, they become "associated reflexes." Not because of any anatomical provision for their association; but simply from habit formed in the central nervous system by receiving these two sensations at the same time and responding to them at the same time.

If a pair of eyes are focused and bifoveally fixated for any distance, when we put plus lenses before those eyes, we move the focus of the optical images forward to a point in front of the retinas, and so set up a sensation stimulating the act of negative accommodation if the person adapts his eyes to the situation for the sake of clear vision.

But this introduction of plus lenses does not create the situation leading to negative vergence, for the retinal images are not displaced away from the foveas. So we are demanding an act of negative accommodation independently from the usually associated negative vergence. This person may refuse to adapt himself to obtain clear vision. But if he does, we may find, on taking a phoria test, that there is a change in the phorias; a previously measured exophoria may be increased, or orthophoria may change to exophoria, esophoria may be reduced, etc. If such a change occurs, the change is the kinesthetic follow-up, or retroflex, stimulated by the revived sensation of the performance of the accustomed double reflex when a part of the habit-formed reflex is excited.

The same associative reactions may follow the use of prisms; with stimulated retroflexes of the muscles which change the convexities of the crystalline lenses, as the result of stimulating vergence by the optical effects of the prisms. For these displace the retinal images away from the foveas, if there is bifoveal fixation before the prisms are placed before the eyes, thus stimulating the reflexes of the vergence.

For example: In making an adduction test at any distance, if we start with binocular focus and bifoveal fixation, as base-out prism power is increased we may reach a point where vision becomes blurred and is cleared by adding minus lenses. This is a retroflex of the positive accommodation drawn into activity from the kinesthetic images revived by forcing the acts of positive vergence. For the base-out prisms displace the images to the temporal sides of the foveas thus exciting a sensation whose reflex is the contraction of the muscles which converge the visual axes, to again place the foveas beneath the retinal images. This is duplicating part of the situation of changing visual attention from far to near.

When we take the abduction, starting with bifoveal fixation, using base-in prisms before both eyes, which displace the retinal images to the nasal sides of the foveas, thus stimulating the reflex of negative vergence, we may reach a point, as prism powers are increased, where vision is blurred and is cleared by adding plus spheres. This reaction of negative accommodation follows, when it occurs, as a retroflex stimulated by the revival of the kinesthetic images of the accustomed double reflexes when the visual attention is changed from near objects to others at a farther distance.

Similarly, by using extra minus spheres we can sometimes increase the adduction; stimulating further contraction of the muscles of positive vergence (convergence) as a retroflex to the stimulation of the muscles of positive accommodation by the sensation of behind-the-retina focus produced by the minus spheres. Or, the advisability of giving a full minus correction might be questioned when before and after phoria tests show a retroflex increase of esophoria; change of orthophoria to esophoria; or too much reduction of exophoria at the reading distance. But there might be special conditions where the retroflex reduction of exophoria by the use of minus corrections would prove beneficial. But we must remember that these retroflexes do not always occur.

There are cases where with the use of full minus correction the adduction might be retroflexly increased, and, possibly a pre-existing exophoria might be decreased, but, by the principles of reciprocal innervation the abduction, at either distance or near, or both, might be decreased. Experience shows it is a poor policy to use a correction which reduces the abduction. There are three points to bear in mind; the retroflex effects; the effects on reciprocal innervation and the effects on tonicity balances.

The most useful of the retroflex tests is the abduction at the reading distance.

In cases of latent hypermetropia and of over-corrected myopia where the near abduction is rather low, if the abduction is rather low and is increased by adding more plus, that patient needs more plus for near work, if he is hypermetropic; or less minus for near work if he is myopic. But too much plus added, more than is needed for best efficiency, will reduce the near abduction. This is one of the few rules in refractive practice which always holds true. We shall refer to this again in discussing corrections for myopes.

By taking advantage of the kinesthetic retroflexes of the negative accommodation when we stimulate the reaction of the negative vergence by base-in prisms, we can often increase the amount of manifest hypermetropia, and so prescribe needed plus corrections without blurring distance vision; and we can often reduce the amount of manifest myopia and so use weaker minus lenses with greater comfort to the patient.

We have described the retroflexes that may be expected to occur when the conditions set up permit them to occur. But normally they may be expected to follow, is not proof that they always will follow.

Thus, in the phoria tests we interrupt and prevent the usual relations in the control of the two eyes and so set up a condition where they are free to wander if a retroflex is stimulated when we add plus or minus spheres. But if there is a retroflex demonstrated in the phoria tests, that is not proof that the same retroflex obtains when the two eyes are not thus dissociated. For the customary visual attention reflexes may counteract any tendencies to kinesthesia if the habits of binocular relations are not interrupted by the diplopia of the phoria test. It depends on which stimulation is the stronger. For instance, when plus lenses increase an exophoria, there is always a question as to whether the patient will adapt himself to those lenses and wear them without complaint or discomfort. It is a hard question to answer.

Experience shows that if the exophoria is increased at the reading distance by a new plus lens correction, there is seldom any difficulty in adaptation; but this may be checked by finding if this plus correction is the one that gives the best abduction, especially as to promptness of recovery of clear single vision after diplopia is produced. For, as is known, too much plus will reduce the near abduction. To that statement we must

add, that even if the breaking point is not reduced, too much plus will reduce the speed of recovery of single vision.

But as to increased exophoria at distance, experience has taught that adaptation is slow; few persons adapt themselves readily; most of them complain. Then a weak base-in prism correction in each lens, 0.50△, 0.75△ or over 1.00△ or 1.50△, will care for the antagonism between the visual attention and kinesthetic reflexes. The cross-cylinder or duochrome tests at 6 meters are excellent for ascertaining the prism power that will give balance.

In the duction tests, if the patient continues to maintain single clear vision as you increase the prism powers, he is adapting himself to an artificial relation to his environment. When he can no longer hold the single image, or when he can no longer hold it in clear sharp focus, nor keep both foveas to their images, he is no longer adapting himself to the conditions your prisms have set up.

There are two causes for blur in the duction tests. One is the retroflex activity of the accommodation muscles, moving the retinal images out of focus. Possibly the other cause is more frequently encountered and more important; but it has not been recognized for what it is until quite recently. Objective measurements of eye movements during ductions show that the eyes seldom turn the same degree as the prisms displace the retinal images; sometimes the eyes turn too far and sometimes not far enough. Therefore the foveas are not always kept to the retinal images. If the retinal image is 3° from the foveal center, it will appear badly blurred, or indistinct; for the acuity at 3° from the fovea is only 20/80 in normal eyes. But the fusion may be retained by many persons through a wide disparity of retinal images. We have one patient who can fuse at 14 inches through 24△ base-in or 24△ base-out prisms without turning her eyes at all! There is no suppression, at any point. Blur commences at 4△ base-in or base-out, and increases as the prism powers displace the retinal images farther from the foveas. At the beginning, she could fuse only 5△ or 6△ prism base-in or base-out. She has acquired this trick of fusing through so much prism power by 60 hours of "fusion training." At the end of this period, observation of eye movements showed she had not changed her "duction ability" at all, but had developed this faculty of fusing over wide retinal areas.

Hence, we may not be too sure in attributing blurpoints in the ductions to change in accommodation, for that is but one of the causes.

In using base-in prisms to reduce the minus corrections of myopes,

we rely on kinesthetic reflexes. But if we wish to avail ourselves of the natural retroflexes, we must establish favorable conditions for them. They will be opposed by other reflexes if we set up conditions such that other sensations will stimulate stronger reflexes.

The purpose in placing base-in prisms before myopic eyes is to incite the stimulation of the reaction of negative vergence with the hope that this will be followed by the retroflex act of negative accommodation, which, of course, would reduce the apparent myopia and reduce the minus lens power needed for clear distant vision. If we start with the lenses giving normal 20/20 vision, and place prisms before these, the result will be zero, so far as any effect in exciting a reaction of negative accommodation. But if the retinal image foci are left in front of the retinas, the myopia only partly corrected, there is the incentive for better vision to re-enforce the kinesthetic reflex; and the stimulus to the retroflex can re-enforce the stimulus of blurred sensation. But if foci of the retinal images are in the retinae, if there should occur a retroflex action of the negative accommodation following the stimulation of the negative vergence by prisms, the foci of the retinal images would be moved behind the retinae; and immediately the sensation of blur would stimulate the reaction of positive accommodation, which would be exactly opposite of what we are wanting for this purpose.

However, the stimulus of blur sensation offsetting retroflex acts can sometimes be used to advantage. In a case of accommodative inefficiency, for example, if the retinal images can be focused, then base-in prisms used to start a retroflex activity of the negative accommodation, and by moving foci of the retinal images to points behind the retinae, producing the sensation of blur, should stimulate a reaction of positive accommodation. In effect, this is exercising the muscles of both positive and negative accommodation, producing flexibility of adjustment. This does not work out in every case of accommodative inefficiency; but sometimes the constant wearing of base-in prism accomplishes much improvement in building up efficient reflexes of muscles of a laggard accommodation.

Thus we get different retroflexes of the accommodation, in using base-in prisms, depending on whether we leave the foci of distant objects in the retinae or in front of the retinae. In the first, the retroflex causes a situation where the visual sensation stimulates a counteracting contraction of the muscles of positive accommodation. In the second, the retroflex effects a situation where the visual sensation demands further contraction of the muscles of negative accommodation.

If you put plus lenses before the eyes and use base-out prisms, if the immediate act of positive accommodation is thereby retroflexly incited, the blur already produced by the strong plus will be increased, for the optical images are thereby set farther in front of the retinae. So negative accommodation may act to offset this as much as possible.

As a second retroflex, negative vergence might become active. But that would be opposed by the presence of the base-out prisms, since the eyes have to be turned inward to keep the foveas under the positions where the prisms have placed the optical images. The total result of such exercise would be better flexibility in the interplay of all reactions, provided it all happens; if the eyes turn as we think they should if we use the prisms; if the direct reflexes for clearer focus and definite fixation follow and offset the retroflexes. Such exercises, with plus spheres and base-out prisms, have been in use many years; at least 30 years in the knowledge of the writer. Sometimes they are very effective in reducing myopia and bringing out more latent hyperopia; sometimes they fail. It all depends on the "ifs." Will or will not the patient's central nervous system respond in this expected manner?

All muscular activities are reactions to sensations which disturb complacency in the central nervous system, thus becoming stimuli demanding action. Therefore, if we desire any definite muscular reaction, we must cause the sensation which will stimulate that action. Hence, the fundamental principle guiding the use of lenses and prisms is to so use the lenses and prisms that they will produce sensations which will stimulate the desired action.

The muscular reflex to the sensation of blur when the image is focused behind the retina is the act of positive accommodation, which results in the increased convexity of the crystalline lens, thus increasing the dioptric power of the eye's refracting system, so the focal point is moved forward to the retina

The muscular reaction, or reflex, to the sensation of blur when the image is focused in front of the retina is the act of negative accommodation; in which the convexity of the crystalline lens is reduced, they reducing the dioptric power of the eye's refracting system so the image focus is moved back of the retina.

The sensation of blur, or indistinct vision, when the retinal image is away from the fovea, stimulates the activity of extrinsic muscles so the fovea is turned to the retinal image for the sake of detailed vision.

When both retinal images in a pair of eyes are to the temporal sides

of the foevas, the muscular reaction for the sake of clear vision turns both foveas temporalward to the retinal images; the fronts of the eyes, or pupils, are seen to turn inward, or nasalward; hence, the visual axii are converged toward the median plane. This is the act of positive vergence, in response to sensations of blur when the retinal images of an attention attracting object fall in retinal areas temporalward from the foveas, where the population of visual sensory receptors is so low that detained representation of the object cannot be delivered.

The act of negative vergence, in which the visual axii are swung away from the median plane, is in response to the sensation of blur, or indistinct vision, when the retinal images fall to the nasal sides of the foveas.

When the attention is fixed on an object at any distance, with the eyes adjusted for clear focus and bifoveal fixation, the retinal images of a nearer object will fall to the temporal sides of the foveas and will be focused behind the retinae, thus producing two types of blur, each demanding its own muscular reflex to place the foveas in the images and bring the focus up to the foveas. In response to these two simultaneously experienced sensations there will be two simultaneously performed muscular reflexes; namely, positive accommodation and positive vergence. In the course of years there grows up an association between the two reflexes, so that if one act is stimulated, the other act follows as a kinesthetic reflex, unless blocked or prevented by an opposing sensation.

When a person is giving attention to an object at any distance with the retinal images in focus and the foveas fixating the images, the retinal images of a more distant object will be focused in front of the retinae and fall to the nasal sides of the foveas. Thus we have the simultaneous experience of two different blur sensations; one because the images are focused in front of the retinae, the other because the images are falling in the nasal areas of the retinae. For the sake of clear vision, there must occur simultaneously two different muscular reflexes; the one being the act of negative accommodation to move the focus back to the retinae; and the other, the act of negative vergence to turn the foveas to the retinal images. During many years of habitual use of these two reflexes, they become so habitually associated that the stimulation of one act is sufficient to stimulate the other act as a kinesthetic reflex, unless counteracted by an opposing sensation.

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ORTHOPTICS AS A REMEDIAL PROCEDURE IN SQUINT AND AMBLYOPIA-EX-ANOPSIA*

REPORT OF A GROUP OF CASES TREATED

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The value of orthoptics as an adjunct to other forms of treatment in cases of squint is recognized as an accepted fact, but its efficacy as a specific remedy for similar conditions is still a debatable subject. Nugent[1] arrived at the conclusion that about 50 per cent of all cases of strabismus can be corrected by refraction, occlusion, atropine, and orthoptic training. This observation with perhaps two exceptions, is shared by this writer. The exceptions are the percentages quoted, and the value of atropine. (Presumably as a means for equalizing vision in the two eyes.) In the first instance our figures are somewhat higher, nearer 70 per cent. In the second, diffusion lenses, as suggested by Hall[2] are far more effective. Total occlusion of the better eye is a highly effective mode of treatment, especially during the early training of amblyopia and suppression. The results are more lasting and much more consistent. The primary purpose of all these methods is to force the use of the amblyopic eye. For occlusion, the eye patch is very effective. More often, however, covering the lens of the better eye with adhesive tape instead of covering the eye itself with an eye patch, tends to render the patient more docile, and consequently, more cooperative.

One very interesting observation brought to our attention by parents and guardians is the noticeable improvement in school work and general demeanor soon after orthoptic training has been started by children whose scholastic standing has been below average, even though no appreciable improvement is apparent in the ocular muscles. This has been noticed especially in cases of nystagmus.
the affected eyes.

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The cases about to be cited and all others were taken in the orthoptic clinic at random, without preliminary determination as to prognosis. Only one of the cases had surgical treatment with no preliminary or early subsequent orthoptic training. All had amblyopia-ex-anopsia of varying degrees and glasses which didn't seem to improve vision in

CASE REPORTS

Case 1. G. G. a girl age 6, was first examined at the eye clinic in October, 1933. The complaint was that vision in both eyes was defective and that it was affecting her school work. On November 25, 1933, an examination under atropine was ordered, and $+.50 \bigcirc +1.00 \times 90$ O.U. was prescribed to be worn constantly. Vision was highly inconsistent and varied, although it was 20/30 at the time of the examination. On January 22, 1936, a change of correction was made and O.U. $+2.00$ D.Sph. $\bigcirc +1.50$ D.Cyl. $\times 90$ was prescribed. With this correction the distant visual acuity, using Snellen charts, was O.D. 20/20; O.S. 20/30—. It continued to vary from 20/30— to less. Without correction the visual acuity was 20/100 each eye. On April 24, 1937, V.A. with correction was O.D. 20/30 O.S. 20/50. Orthoptic training for the correction of amblyopia-ex-anopsia was advised after a thorough physical and ocular examination in which all findings appeared normal. Training was started soon afterwards.

Orthoptic training was directed toward developing visual acuity and binocular coordination (fusion) which was definitely lacking. There was no apparent strabismus, and no diplopia could be induced to accurately determine the extent and type of phoria. (The patient was uncooperative even for an objective determination by the cover test.) In October, 1938, visual acuity Snellen charts was 20/20 with and without correction. She had very good fusion amplitude and good stereopsis.

This patient was discharged as fully corrected on February 11, 1939, at which time her distant vision with correction was 20/20— each eye; uncorrected 20/30. She showed normal retinal correspondence by the Hering After Image test, 100% fusion (Keystone Progress Fusion Cards) and good stereopsis. At near the patient read Jaeger No. 1 type with and without correction.

Case 2. F. H. a boy of 12 was examined at the eye clinic for the first time in August 1934. He had left esotropia of approximately 30°. His visual acuity was; uncorrected O.D. 20/20; O.S. 20/40; with old correction O.D. 20/20 — 2; O.S. 20/40 — 1. The eyes were re-ex-

amined under atropine and prescribed: O.D. + 2.00 D. Sphere = 20/20; O.S. + 1.75 D. Sphere = 20/40. They were again examined in July 1935, but no change of correction was made. The boy was referred to the orthoptic clinic for the treatment of the left esotropia and amblyopia.

An orthoptic routine examination was made and the following data obtained:

No fusion or stereopsis
Periodic left suppression
Intermittent binocular perception (Dog and Pig card only)
Angle of deviation on perimeter—25°

The boy was examined at the children's clinic and was found to be in good physical condition.

He started treatments on August 10, 1935, and was to continue three times weekly, which he did with much irregularity. On May 1st, 1937, the patient left the clinic altogether and stopped treatments. Visual acuity taken previously was

O.D. 20/20
O.S. 20/20

The esotropia was still apparent.

The patient was again examined in February 1940 and the following correction was prescribed:

O.D.+1.25D. Sph.=20/20
O.S.+1.00D. Sph.⌒+25 D. Cyl. × 180=20/20

He didn't, however, return to the orthoptic clinic for additional training of the eye muscles.

Case 3. Miss I.G. age 16, came to the clinic on August 14, 1935 complaining that she had lost sight in the left eye. She had glasses, O.D.+4.00 D.Sph., O.S.+4.50 D.Sph.⌒+.50 D.Cyl. x 180. Visual acuity taken with and without this correction was O.D. 20/30; O.S. no light perception or projection. The fundi, pupillary reactions to light and accommodation, the media and the ocular versions, rotations and tension were examined and found to be normal. A medical, neurological and X-Ray (skull) examination was made and the reports were negative. Field studies were attempted but without success.

Past History: In 1924 the patient was examined and was found to have left esotropia O.U.+4.00 D.Sph. was prescribed at that time. This correction was increased to O.U.+5.00 D.Sph. in 1925. That same year

the prescription was again changed to O.D.+4.00 D.Sph. O.S.+3.75 D.Sph. Visual acuity with this correction was O.D. 20/20; O.S. 20/20—2. The patient continued to maintain the same visual acuity during subsequent examinations and lens changes until 1927. In that year vision in the left eye with correction was recorded as 20/40. All examinations were made with atropine. In 1929 she returned for reexamination and no change of glasses was indicated, but the visual acuity was recorded as: O.D. 20/30; O.S. 20/200—. There seemed to be a progressive loss of vision in the left eye, since the esotropia was corrected surgically in 1928. She was aware of the variation in vision of the two eyes and became very much perturbed when she noticed complete loss of sight in the left eye on August 14, 1935.

Because of the absence of ocular and systemic pathology or any clinical signs, diagnosis of visual hysteria was made following a consultation with the social service worker under whose care I.G. had been in the past and also at this time, and who was intimately familiar with the girl's home and social history. Of course the possibility of retrobulbar neuritis or multiple sclerosis were not entirely ruled out.

To confirm this diagnosis the patient was placed in front of the Keystone Telebinocular. The right eye was completely occluded with an eye-patch, in addition to which the cell of the instrument was filled with cotton gauze, and a black occluding disc was placed over the lens in the eyepiece. A tin can wired for a socket into which a 15 watt bulb and a flashing device were placed, was used in the left cell of the instrument.

The patient was not told of the impending experiment or what to expect. She was told to look into the eyepiece of the telebinocular, and to sit quietly. When suddenly the light flashed on, she jerked her head away from the instrument, thus registering the sensation of light stimulation. She explained that she felt something. What it was she didn't know.

We repeated the experiment several times with the same reactions manifesting each time. We then tried to determine the sensation of motion. And, if possible, the perception of color.

To determine the perception of motion we utilized the same instrumentive set-up as in light perception, only instead of a flashing bulb, we used colored plates and moved them slowly in the field of vision. The position of the holder into which these cards were placed, was changed from 00 to the limit nearest the eyes. When the latter position was reached, the patient reported that she "thought she *felt* something mov-

ing." This test also was repeated several times with the same results manifesting.

A training program directed toward the restoration of vision in the affected eye was outlined and training started on September 21, 1935. The program consisted of:

1. Light and object perception training on telebinocular, employing color plates and visual acuity cards.
2. Light flashing one minute intervals, resting three minutes, using blue glass filters and to try other color filters.
3. Macular fixation and foveal projection training.
4. Monocular fixation training.
5. Binocular coordination training.
   a. Superimposition training.
   b. Duction and fusion training.
   c. Stereopsis training.

The training program was started on September 21st. The card holder on the telebinocular was set at 3.00 D., and the patient reported that she could see the cards and the objects on them. The card holder was moved away from the eyes and at 1.75 D. on the card holder, she reported that objects appeared blurred. The results at this time were considered gratifying. We continued this form of treatment through to October 19, 1935, when she was starting on near point reading. I.G. read at 13 inches without the slightest effort, stories in books the type of which was similar to that of Jaeger V-2D. size. In addition, macular fixation and foveal projection training was given. At first, Snellen visual acuity cards were used for this purpose. The patient was asked to name, point, and outline the letters, commencing with the very largest and gradually reducing in size as progress was being made. Afterwards, projection training plates devised by this writer were used.* (3)

At first progress was painfully slow, but by January 1936, the patient was ready for home work in addition to the training at the clinic. Home work consisted of the following procedures: Total occlusion of the right eye (this was only partially carried out at home). Projection training (we supplied one of the plates and toothpicks). Tracing letters

*These plates consist of pictures of objects drawn on cardboard. Small holes are punctured in different parts of each picture and the patient is required to fixate these holes and project colored toothpicks into the holes. The amblyopic eye only is used, the better eye being occluded.

in newspapers (headlines), selecting and naming letters and copying them.

In February 1936 projection was good, and tracing, visual acuity training, and near point reading were added to the program. Rapid improvement was being made in the visual acuity of the affected eye. In October 1936, the visual acuity with correction was O.D. 20/30; O.S. 20/50. Without correction: O.D. 20/20; O.S. 20/50.

The patient was ordered refracted under homatropine but failed to keep the appointment. She returned six months later and told us she was carrying out the treatments at home. Vision at this time with correction as: O.D. 20/20; O.S. 20/20—. She refused to submit to further training and because of this, the second phase of the program—that of binocular coordination had not been carried out.

This patient was extremely uncooperative and at times, even trying. A mental hygiene program, included in the general treatment procedure was attempted but with little success.

Case 4. D.P., age 7, has been a patient in the eye clinic since August 1931. He had left esotropia 30°, and amblyopia-ex-anopsia. He was referred to the orthoptic clinic on September 26, 1935 following atropine refraction and change of correction to O.U.+1.00 D.Sph.

When first examined in September 1931, the following data was obtained:

V.A. O.D. 20/20; O.S. 20/200 uncorrected.

The eyes, with the exception of the esotropia were normal in every way. His general health, likewise, was good.

Refraction was done under atropine and O.U.+1.00 D.Sph. prescribed for constant use. He was reexamined in July 1932 and although a change to +150 D.Sph. was indicated, it was not advised. In August 1933, the patient was again refracted under atropine and was found to need O.U.+1.50 D.Sph. V.A. O.D. 20/20; O.S. 20/100, but glasses were not changed. This was repeated yearly until September 1935 when D.P. was referred to the orthoptic clinic for training.

The orthoptic examination revealed left esotropia of about 25° measured on the perimeter with and without correction. Ocular rotations were fairly smooth. The ocular versions to the left were good, but left eye versions to the temporal side indicated insufficiency of the left inferior oblique muscle on repeated tests. V.A. with and without correction:

O.D. 20/20; O.S. 20/100. He was still using the O.U.+1.00 D.Sph. Fusion was lacking and marked left suppression was indicated. Retinal correspondence by the after image test was questionable. A training program consisting of the following steps was instituted:

1. Stimulation of O.S. only—flashing light, projection, tracing.
2. Visual acuity training—near and distant.
3. Binocular fixation training.
4. Superimposition and duction training.
5. Fusion and stereopsis training.
6. Version and rotation training during duction calisthenics.

Training was started on October 19, 1935 and on November 4th, visual acuity was: Uncorrected: O.D. 20/20; O.S. 20/50—2: Corrected: O.D. 20/20; O.S. 20/40—1. The muscular abnormality was definitely hyper-esotropia instead of simple esotropia. (The hypertropia being of low degree.) Suppression was being gradually eliminated. The patient reported occasional diplopia.

In May 1936, a new refractive examination was ordered and the correction worn was duplicated in a larger size frame. He was still wearing O.D.+1.00 D.Sph. 20/20; O.S.+1.00 D.Sph. 20/50.
D.P. discontinued orthoptic training following the refraction, and this case was not completed.

Case 5. E.B., female, was 6 years old when first seen in the eye clinic in August 1929, for the treatment of an existing alternating esotropia. Her eyes were examined with atropine and found to require O.D.+3.00 D.Sph.; O.S.+2.50 D.Sph. No record of the visual acuity with this correction was made, but uncorrected, her visual acuity was O.D. 20/100; O.S. 20/20.

In January, 1930, the patient was given (under atropine):

O.D.+.50 D.Sph.⌒+.25 D.Cyl. x 75—V.A.? (not recorded)

O.S.+1.00 D.Sph.⌒+.25 D. Cyl. x 105—105V.A.?

On August 31, 1934, her uncorrected visual acuity was O.D. 20/100; O.S. 20/20. E.B. was reexamined for glasses and prescribed

O.D.+.50 D.Cyl. x 90 20/100

O.S. +.50D.Cyl. x 90 20/20.

The amblyopia in the right eye persisted and could not be improved with glasses as subsequent attempts proved. On January 18, 1936 the patient was referred to the orthoptic clinic for treatment.

The orthoptic examination disclosed right esotropia of approximately 10° (on perimeter), right suppression, and amblyopia. There was no fusion. The ocular versions and rotations were smooth and extensive. Projection and fixation functions were faulty. The vertical eye muscles appeared normal.

A training program consisting of the following steps was started on March 14, 1936.

1. Right eye visual acuity training both near and distance.
2. Projection and fixation training for the elimination of these faults and suppression.
3. Monocular and binocular fixation training.
4. Binocular coordination training.
   a. Superimposition
   b. Fusion
   c. Duction
   d. Rotational and horizontal calisthenics
   e. Stereopsis training.

All training was to be done with and without glasses.

The left eye was occluded while in clinic and the patient was instructed to do likewise at home for as long periods as possible. She was to come to the clinic three times weekly. In June 1937, vision in the right eye was 20/50 Snellen, and in July she read all the letters on the 40-foot line and continued to make progress. In September 1937, vision was 20/30 Snellen and E.B. was started on binocular coordination training.

On October 9th, 1937, patient reported diplopia when looking toward the right, and the vision with the right eye at near was much clearer. The patient continued to show improvement and was finally discharged as fully corrected October 22, 1938. A post-orthoptic examination revealed the following findings:

V.A. Corrected: O.D.20/20—1
O.S. 20/15 O.U. 20/15
Uncorrected: O.D. 20/20—3
O.S. 20/20

Single binocular vision, no suppression, normal retinal correspondence by the after image test, 100% fusion (Keystone Fusion Test) and excellent stereopsis. Cover test showed orthophoria.

Case 6. C.C., male, was two years old when he first appeared at the

eye clinic on November 2nd, 1932, for the treatment of a right convergent strabismus. He was refracted under atropine and had prescribed from the retinoscopic findings. O.D.+1.50 D.Sph. O.S.+2.00 D.Sph.

The patient was again examined on July 9, 1934 and the left lens only was changed to +2.50 D.Sph.⊂+.75 D.Cyl. x 90. On September 9, 1936, he was again examined. The right esotropia of approximately 30° remained unchanged and glasses didn't seem to improve it. A prescription for new lenses was given on September 25, 1936:

O.D.+2.50 D.Sph. —V.A.?

O.S.+3.00 D. Sph. —V.A.?

On September 18, 1937, C.C. was reexamined and no change of glasses was indicated. His visual acuity (Snellen) was:

Uncorrected: O.D. 15/200 Corrected: O.D. 20/200

O.S. 20.40—2 O.S. 20/30—1

The patient was referred to the orthoptic clinic for training. On September 18, 1937, an orthoptic examination was made and the following data obtained:

1. Normal retinal correspondence by after image test.
2. Right esotropia approximately 15° measured on the perimeter.
3. Distance visual acuity, corrected: O.D. 20/200; O.S. 20/30—1. Near point: largest newspaper headline type.
4. Ocular excursions normal, extensive and smooth.
5. No fusion.
6. Right suppression and faulty projection.

A training program consisting of the following steps was instituted.

1. Retinal stimulation
2. Fixation, visual orientation, and projection training
3. Visual acuity training, near and distance
4. Binocular coordination training
5. a. Monocular and binocular fixation training
   b. Superimposition training
   c. Fusion, duction and stereopsis training
   d. Ocular version, rotation and horizontal calisthenics

Home Work:

a. Total occlusion of left eye
b. Tracing and projection training

Training proceeded uneventfully. The patient came to the clinic three times weekly, and treatments lasting between fifteen and twenty

minutes each were given. He was not overly cooperative; his mother had to be called in on several occasions in an effort to obtain better cooperation. His home work was carried out sporadically and all attempts to make the boy wear an occlusion patch outside of clinic were useless. Nevertheless, when C.C. was finally discharged on March 15, 1941, he had V.A. O.D. 20/20; O.S. 20/20, with and without correction. Amplitude of accommodation 9.00 D. O.U. Fusion 100% Keystone Progress Fusion Cards Good stereopsis. No indication of tropia by any test.

Case 7. F.G., female, age 16, was referred to the orthoptic clinic on December 11, 1936. She was wearing glasses O.D.—3.00 D.Sph.⊖ —.50 D.Cyl. x 90; O. S.—1.25 D.Sph., which were prescribed sometime previously. Her visual acuity was Uncorrected: O.D. 10/200 O.S. 20/100 Corrected: O.D. 20/50 O.S. 20/40

There was no apparent muscular abnormality or ocular pathology, and the eyes in general were found to be normal, as were the form fields. The only apparent abnormality was amblyopia-ex-anopsia.

The training program in this case consisted of steps designed essentially for the restoration of vision and consisted of the following steps:

1. Retinal stimulation (binocular) and monocular
2. Visual acuity training (monocular) and binocular—more O.D. at distance and near.
3. Projection and fixation training.
4. Ocular calisthenics, fusion and stereopsis training to stimulate binocular functions.

Training was started on January 2, 1937, and was continued once weekly until February 20th at which time the visual acuity (measured January 23rd) was O.D. 20/30; O.S. 20/20. The patient was supposed to return on February 27, 1937, but failed to do so on that date, or on any subsequent one.

Case 8. Nine-year-old H.McM., female, was examined for the first time in the eye clinic on June 11, 1935, and given

O.D.+75 D.Sph.⊖+ .75 D.Cyl. x 105—20/20
O.S.+75 D.Sph.⊖+1.00 D.Cyl. x 105—20/50
Uncorrected vision at the time of the first examination was O.D. 20/30 O.S. 20/200

On October 22, 1936, the girl was reexamined. Visual acuity was O.D. 20/40; O.S. 20/200, with and without correction. Glasses were not

changed. Instead, the patient was referred to the orthoptic clinic for training of the amblyopic left eye. This was started on December 12, 1936.

On April 3, 1937, patient was reexamined and had glasses duplicated because the others were lost. The only change was in the axis of the left lens to 75°. The visual acuity with glasses at this time was O.D. 20/20; O.S. 20/50. She was to continue with orthoptics and all work was to be done without glasses. The training program in this case was similar to that of the one cited previously.

On September 27, 1937, vision in the left eye without glasses was 20/40—2. In December it was 20/20—4, and continued to improve so well that by January, 1938, it was 20/20 in each eye. Patient was discharged as fully corrected on July 13, 1938. The post-orthoptic examination disclosed the following data:

Normal retinal correspondence by the after image test
Orthophoria at distance by all tests
Excellent fusion and stereopsis and good fusion amplitude
Visual acuity with and without correction: O.D. 20/20; O.D.20/20
Amplitude of accommodation 13 D. O.U. and each eye separately.

Case 9. A.S., age 7, female, was seen in clinic for the first time on September 3, 1937. The glasses which she had been wearing for some time neutralized as:

O.D.+2.50 D.Cyl. x 105
O.S. +2.50 D.Cyl. x 75

The visual acuity with this correction was measured on the illiterate chart and recorded as 20/100 each eye. This could not be improved with new glasses following refraction with atropine. The child was referred to the orthoptic clinic and training was started on October 23, 1937.

The orthoptic routine examination disclosed the following data:

Normal retinal correspondence by after image test
Periodic left esotropia 15° measured on the perimeter
No fusion or stereopsis
Periodic left suppression
Ocular versions and rotations were smooth and extensive
Accommodation amplitudes differed between the two eyes, being: O.D. 13D. O.S. 10D.

A training program consisting of the following steps was instituted:

1. Visual acuity training at near and distance O.D., O.S., and O.U.
2. Development of projection, fixation, and attention reflexes for the elimination of suppression tendency.
3. Ocular calisthenics. Base In.
4. Monocular and binocular superimposition training.
5. Duction and fusion training and the development of an amplitude of fusion and stereopsis.
6. Accommodation training.

In the course of training, the eyes were reexamined but no change of glasses was indicated. Orthoptic training was continued until January 28, 1939, when A.S. was tentatively discharged. The post-orthoptic routine showed the following findings:

Normal retinal correspondence by the after image test
Normal fusion (100% Keystone Progress fusion and Wells Cards)
Orthophoria by cover and other tests
Visual acuity with correction: O.D. 20/30; O.S. 20/30; O.U. 20/20.

The patient returned once each month for progress check-ups and the results were highly gratifying. A new refractive examination was done on September 30, 1939, and new glasses prescribed:

O.D. $+1.25$ D.Sph. $\bigcirc$ $+3.00$ D.Cyl. x 120 V. 20/30
O.S. $+1.25$ D.Sph. $\bigcirc$ $+4.00$ D.Cyl. x 75 V. 20/30

Case 10. C.W., male, age 13, was referred to the eye clinic from the children's ward for consultation as to the possible cause of his poor vision. The medical history was that the boy had frequent colds, probably because of a deviated septum. Other than that, his health was good. He was unruly and uncooperative, his mother being too occupied by outside matters to descipline the child. Neurological examinations disclosed nothing abnormal.

The eye examination disclosed no apparent ocular pathology, either internal or external. The visual acuity was O.D. 20/200; O.S. 20/200 —1. The boy had no glasses. The extra-ocular muscles appeared normal. It was difficult to determine the accommodation amplitude or visual fields.

A refractive examination under atropine indicated retinoscopically O.D. $+.50$ D.Sph. O.S. $+.75$ D.Sph.

Subjectively, he accepted O.U.+.50 D.Cyl. x 180, which gave 20/50 vision. A tentative diagnosis of possible hysteria or ciliary spasm was made, but no glasses were prescribed. Instead, the patient was referred to the orthoptic clinic for training.

The training program consisted of the following steps:

1. Visual acuity training
   a. Monocular retinal stimulation using ruby filters
   b. Tracing on flashing box, monocularly, first right, then
2. Ocular version and rotations and calisthenics, mostly base-
   left eye
   c. Visual training near and distant, Snellen and Keystone
3. Duction, fusion and stereopsis training.
   cards, books.

Training was started in May 1937, and after 17 orthoptic treatments, patient's distant vision was 20/20 O.U. His near vision was
in effect
good, and the ductions were 22 prism diopters Base Out, and 9 Prism diopters Base In. He had good fusion and accommodation amplitudes and good stereopsis. He was discharged on August 4, 1937, as fully corrected. No glasses were prescribed.

Observations:

The few cases selected for this report are but a few of the number treated and discharged either as fully or only as partly corrected. As can be gathered from the report, those which were only partly corrected, in most instances, showed lack of cooperation and failure to complete training. Strict attention to the task, regularity in clinic attendance, and earnest cooperation between the patient, his parents, and the doctor, can greatly enhance the value of orthoptic training. A much higher percentage of corrections can be had by following and adhering to such rules.

Failure or successful termination of an orthoptic case depends greatly upon the procedure employed. Orthoptic training, such as now employed by this writer is not the simple fusion training procedure which is mentioned in text books and occasionally in periodicals. Ours is a sound and very complete procedure in which physiology, physiological optics and psychology play important parts. It must be remembered that strabismus patients have abnormally developed visual habits. As such, they do not know what normal visual functions are, or what they are supposed to be

like. Although binocular vision is an innate function, its disruption (as in strabismus) in no way seems to evoke sympathetic action from either the eyes themselves or from the tributary functions having to do with binocularity. Deterioration seems to set in without hindrance. In fact, it is often aided by processes regarded as benign, as is the case with suppression and amblyopia.

Our procedure follows very closely the natural development of the visual function. We start with the rehabilitation of the amblyopic retina and macula. These are stimulated with the only element to which they have an affinity—light. Such macular functions as fixation and projection are stimulated and intensified. A path of conduction between the retinal fibres and those in the higher cortical centers is reestablished. The affected eye is put to work and is forced to partake in normal visual functions as it would have normally. Once response is established, it is intensified by increased amounts of work and longer periods of training.

Our procedure is divided into two parts. The first part is devoted to the training and development of the visual functions. The second deals with the training and development of the binocular coordination facility.

Training of concomitant strabismus, almost without exception, is started with the first phase of the treatment procedure and carried out intensively until the maximum point of development is reached. After this is accomplished, the second part of the program is started and carried to completion.

It will be noted that in several cases, identical, or nearly so, training procedures are employed. This tends to disprove a contention often made that each strabismus case is a case unto itself and must be treated as such. Our experience has been that it is possible to use a basic procedure in most cases of similar nature and apply variations in technique after the underlying faults have been eliminated.

The time element is very important. Orthoptics is one type of ophthalmic treatment which can not be hurried and which requires persistence, perseverance and lots of patience. All these consume time. Speed in the responsive reaction varies with the patient. In one instance, it may be possible to eliminate suppression and amblyopia in a few weeks, while in another similar case, it may take months, or even a year or longer. We consider two visits a week as a minimum number of treatments to produce a beneficial continuity of results. Considering that each treatment can not be of too lengthy duration, 30 to 45 minutes, the actual

amount of time spent weekly in using the affected eye is rather meager when it is compared with the length of time that the eye is permitted to remain dormant. We find daily visits as most effective.

Home training is most effective when rigidly supervised. We seldom give as home training, work belonging to the second phase of the orthoptic procedure. Tracing, projection, visual acuity and similar training can be carried out at home under careful supervision. Fusion training, however, should be relegated entirely to the orthoptic room. It requires careful and expertly trained supervision and repeated checking. This can be done only by a trained orthoptist.

From observations in these and other cases, previously reported, several factors, such as age, instrumentation, duration of treatments and tests for predetermining likelyhood of outcome, have been learned. As can be judged from the cases reported at this time (and from clinical experience with others) advanced age is not so much a hindrance as thought. It may prolong a case and make its training more difficult, but the prognosis may be favorable. The tests available for predetermining the prognosis of an orthoptic case, are, at best, highly inadequate. It is because of this that we do not draw the line as to the kind of patients who are admitted for orthoptic training. We are hoping in that way to create some sort of a system of selectivity that would embrace not only the best age groups most suitable for training, but also the types of cases most amenable and a set of reliable tests.

While there is no apparent dearth of orthoptic training equipment, nearly all those available fall short where it pertains to the early stages of training, especially for children of pre-school age, both amblyopic as well as non-amblyopic. Training of visual acuity, for example, with the Snellen charts available (and even those for illiterates and children) is not as effective as it would be with charts of objects of which are familiar to children. We drew free-hand several such charts in scale and are using them quite effectively.[3]

There is much yet to be learned about orthoptics. Every case successfully treated and reported adds to the already accumulated storehouse of knowledge.

DR. WILLIAM SMITH
300 SEAVER ST.
BOSTON, MASS.

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ORTHOPTIST'S WORK WITH THE ROYAL AIR FORCE IN ENGLAND*

But for the work that goes on day after day on the fourth floor of a modern block of offices in the heart of London many a bomber or fighter pilot would be eating out his heart on ground duties.

To the RAF Orthoptic Clinic are sent pilots whose eyes need overhauling. Ninety per cent of them return to their squadrons after an absence of three weeks—to continue their work in the air.

But for the team of orthoptists at the clinic a young D.F.C. bomber pilot, who thought that his career was finished with a total of 950 flying

*British Information Services, February 6, 1943.

hours to his credit, would not now be back in the air. The trouble started when he found difficulty in landing his aircraft. He was unable tc focus his eyes on objects approaching rapidly as he made to land. He was sent to the clinic and now he is with Ferry Command, flying all types of aircraft. Three weeks of eye exercises on the instruments enabled him to get over the trouble.

Then there was a squadron leader who narrowly missed being grounded. He had a day-flying record of more than 3,000 hours. But when he began night operations his landings were erratic. This led to a number of awkward questions from his commanding officer, and eventually he was obliged to reveal his weakness.

It appeared that he had been able to judge his landings in daylight only by estimating the size of fences, stores, and trees as he came in to land; thereby he gauged how close he was to the ground. At night, when those familiar objects were no longer visible, he had to trust to luck. He no longer trusts to luck. The clinic has restored his visual judgment, concentrating here on streoscopic exercises.

The head of the RAF opthalmic department, an old Cambridge rowing blue, who served in the TBD's in the last war, held appointments at the London Hospital before joining the RAF in 1920. He started to specialize in orthoptics, a subject which became increasingly absorbing as the years rolled on and the dark clouds of war began to gather again. He realized that the strain of war-time operations would produce such troubles as defective visual judgment among pilots.

He was one of the few who saw the need for the development of orthoptics in the RAF, and, because of the foresight of those few, Britain is claimed to have a clear world lead in scientific correction of airmen's eye troubles.

He declines all the honor for what is now being achieved. He has gathered round him a band of 33 orthoptists, who now serve as WAAF officers and who joined in small numbers as the need for their services grew

Latent eye muscle troubles often come to light when a pilot changes to faster and bigger planes, and an observant commanding officer will in suitable instances see that the man is placed in the hands of orthoptists after a full examination has been conducted by the ophthalmic surgeons of the department.

If pupils at training schools persist in inaccurate handling of aircraft near the ground, they are not necessarily dismissed out of hand as

unsuitable material, but may be sent to the clinic in case there is some ocular reason for their inability.

The ophthalmic surgeons do not pretend to be able to cure myopia or ocular diseases by visual exercises; they do not claim to be able to restore sight, but they *do* say that properly conducted orthoptic treatment offers a good chance of correcting defects associated with visual judgment and certain types of "eye-strain."

Night-vision testing demands of the candidate both concentration and intelligence as well as the power to see in the night; yet of the tens of thousands of recruits who have gone through it, only about two per cent have failed to make the grade. An instrument known as the Rotating Hexagon is used. Covered with rows of of letters and silhouettes of ships, aircraft and other objects, this instrument, by using the rheostatic control, can simulate night visibility conditions ranging from a night sky under a full moon to a starlit sky with no moon.

The recruits sit in complete darkness round the instrument, after having worn dark goggles for about 15 minutes, and waited a further 15 minutes in total darkness. The Hexagon is illuminated very faintly and the recruits are allowed one minute to study the letters and silhouettes from a distance of three feet. They then have to copy them down on a Braill card. To cope with the number of recruits for flying duties, a travelling unit visits all RAF stations to give night-vision tests.

The effect of high-altitude flying and oxygen on the eyes has been engaging the attention of medical and scientific workers in many lands. It has been found that lack of oxygen may lead to failure in night vision even at moderate altitudes.

MONOCULAR OCCLUSION IN ANISEIKONIA

At the meeting of the New York Academy of Optometry held on March 23rd at the Hotel McAlpin, the guest speaker was Dr. Robert E. Bannon of the Dartmouth Eye Institute whose subject was "The Diagnostic Value of Monocular Occlusion."

Dr. Bannon stated that the covering of one eye has been used for many years in the investigation of muscle imbalances or the relief of symptoms that would not respond to any other therapy. In the research work in aniseikonia done at Dartmouth monocular occlusion has been applied in a number of cases which had not been helped previously in regular practice. Before a final diagnosis of the case was made the non-

dominant eye was covered for two weeks. If the patient was more comfortable at that time than before, aniseikonia was suspected as well as some accommodative-convergence disorder. In the great majority of cases aniseikonia was found and when corrected, afforded relief from the former binocular discomfort. It was pointed out that this not only served as a method to study the muscular condition, but also was an excellent screening test to show the patient that his troubles were due to the eyes rather than some other cause. Furthermore, in some persons the best means known at present to treat their symptoms is permanent occlusion.

JOHN W. MOGEY

SPECIAL REPORTS

RECOMMENDATIONS PRESENTED TO THE COMMITTEE ON SOCIAL WELFARE BY THE SASKATCHEWAN OPTOMETRIC ASSOCIATION*

A. J. Orchard, Opt.D., H. S. McClung, Opt.D., H. C. Arnold, Opt.D., F. C. Bowers, Opt.D., and G. A. McCuaig, Opt.D.

Saskatoon, Saskatchewan

The Saskatchewan Optometric Association through its Council and at the request of the Select Special Committee re Social Welfare, submit the following representation:

At the outset, we must commend the Government for their foresight and sound judgment in their efforts to solve the problems involved in such a vast program of social service. Saskatchewan may well be proud of its health program as evidenced by free tubercular treatment and energetic efforts to detect it in its incipiency. The municipal doctor scheme originated in this province and the cancer clinics are doing a marvelous work. We note, with pleasure, press notices indicating the very gracious and interested consideration your committee has shown during hearings of this nature.

The recent plan of Social Welfare submitted by Minister of Pen-

*Submitted on March 27, 1943, for publication in the May, 1943, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

sions, Honourable Ian MacKenzie, in his review of a Health Insurance Bill for a joint Dominion-Provincial Act, together with the information submitted by Dr. Marsh to the House of Commons is indicative of a general philosophy. This philosophy has been growing in magnitude for the past twenty years and in summation seems to postulate that Canada will never reach its fullest and best development until certain basic, fundamental living standards are assumed by all its citizens. In addition, this philosophy enunciates that it is the duty of all citizens, through their representative governmental acts and agencies, to assure to each and one another, by whatsoever means are possible, these fundamental living standards. The realization of this philosophy and the knowledge gained from our extensive experience and work in the health and visual fields prompts us to submit our representation and to state that we do subscribe to the necessity of a social security scheme.

Our report will be confined to the field of visual welfare, eyesight care and conservation of vision insofar as optometry is directly concerned.

As optometrists we are deeply interested in any matters of health in Canada being closely allied to the medical and dental professions and practising throughout the province of Saskatchewan in a manner governed by our Saskatchewan Optometry Act.

A survey of the need and availability of means to take care of visual welfare of the people of Saskatchewan:

The sight care of the people of Saskatchewan is at present taken care of by some 100 members of the medical and optometrical professions. There are 50 optometrists in Saskatchewan and these are fairly well distributed about the province. While accurate figures are not in our possession, we believe that there are approximately 50 medical refractionists who are doing refractive work. Thus we have 100 practitioners administering to the visual needs of 900,000 people. Surveys made in Canada, the United States and Great Britain have repeatedly revealed that 70 per cent of its people need visual assistance in one form or another. One and a half per cent of the population need visual care of such a nature as to be classified pathological or traumatic. Therefore we have 630,000 people needing optical and medical assistance and about 10,000 needing medical aid. This means that there are 6,300 probable patients for each practising optometrist and medical refractionist.

Present day methods of supplying Visual Care:

In Saskatchewan the public have access to four means of caring for their visual needs. In a report given to the Saskatchewan Government in 1936 by the Saskatchewan Optometric Association these means were discussed. We shall review them here:

An individual may consult:

1. An optometrist,
2. A medical refractionist

or he may buy glasses from

3. A counter sale establishment,
4. A mail order establishment.

Properly speaking, when an individual is examined by an optometrist the prime concern of the optometrist is to establish the all around visual condition of that individual. Glasses are not sold as a commodity. They are used as a therapeutic device where a full analysis of the person's visual status indicates their efficacy. Hence the counter sale and mail order sale of glasses constitutes a prostitution of a therapeutic device which should be administered only under proper supervision and by skilled practitioners. Since many have the erroneous impression that an examination of their eyes is for the purpose of selling a pair of glasses and through this ignorance or possibly through inability to pay for proper professional advice, resort to counter sale or mail order glasses, this in itself is in part a condemnation of our present set-up. It is our opinion that ignorance is the greater factor and it has been optometry's contention that the mail order and counter sale of glasses should be prohibited.

Our public school children receive a superficial eye test for visual acuity and ocular diseases either by the school doctor or school nurse in the cities, or in the country by the school nurses sent out by the department of health. In cases of low visual acuity these children are given a report which they take to their parents. Apart from this very little has been done to correct and curtail the serious eye defects found amongst our population.

A plan for Visual Welfare under a Social Welfare Scheme:

We believe that under a Social Security and Health Insurance plan all citizens should have like benefits of optometrical care.

We submit that the following benefits while not being the fullest would provide a major step forward in caring for our citizens,

1. *Eye examinations*:

Eye examination should be available to all citizens on a basis such that:

(a) All school children up to and including grade 8 should be examined by trained optometrists or medical refractionists once a year. A method of doing such examining, of accurate "screening out" of the normal, and of recording from year to year the findings is immediately available and optometry would be willing to assist at once. It is a matter of grave concern to optometry that myopia, according to authorative figures increases 600% between the first and eighth grades. This results in boys and girls dropping out of outdoor games with detriment to their physical and social development and in a national crisis men are rejected from military service because of low visual acuity.

(b) All adults and high school children should have access to thorough optometric care either from an optometrist or medical refractionist. It is established that many cases of cataract and glaucoma are due to the absence of visual care and results in premature senility and blindness.

2. *The prescribing of optical corrections*:

Wherever necessary in the cases of (a) and (b) above, optical corrections should be prescribed, properly fitted and accurately checked either by an optometrist or medical refractionist. Material used should be left to the discretion of the prescribing practitioner.

3. *Visual re-education and orthoptic training*:

Wherever necessary in cases of (a) and (b) above, visual re-education and/or orthoptic training and/or optical corrections should be instituted. This implies that a school child or anyone needing reading training or having a muscular anomaly or lacking one or more of the factors constituting normal visual function in addition to needing a correction or not should be able to avail himself of the proper visual care, re-education and orthoptic training.

4. *Fitting, adjusting, replacements, breakages, etc.*:

Where an optical correction is being worn and fittings or adjustments are necessary and where the replacement of damaged, defective or

broken materials are necessary, the individual should be provided with the full professional skill of the optometrist or medical refractionist.

5. *Pathological and traumatic cases*:

All cases of a pathological or traumatic nature consulting an optometrist should be entitled to a full and proper report to be sent to their physician or oculist.

6. *Special cases*:

Those cases needing special visual aids as for example contact lens and telescopic lens should be able to avail themselves of these aids through the medium of an optometrist or oculist.

7. *Progressive Reports*:

All optometrical patients should be permitted to avail themselves of a progressive report on their case at least every six months. The report would be a survey of the progress attained in a case after six months of visual care, and, would preclude many undesirable changes taking place.

The practitioner-patient relationship in the plan outlined above:

Under a social security visual welfare plan as given, the relationship between the patient and practitioner should be clearly defined. In our opinion a relationship constituting a medium whereby the greatest professional skill on the part of the practitioner can be obtained is necessary. This medium is best summarized as follows:

1. The plan should be extended to all residents of the province.
2. All examinations, services, re-education, orthoptics, etc., should be done in the practitioner's office excepting in cases where school and industrial clinics are being conducted and in cases where special needs cause the practitioner to do otherwise.
3. Individuals should be permitted to choose their own practitioner.
4. That there should be no interference with optometry as regards professional and ethical development.
5. That the need for optometrical services should be determined by optometry and medicine.
6. Every optometrist in good standing to be eligible to practice under the plan.
7. An optometrist should be placed in charge of any plan involving visual problems or care.

Fees and their payment:

A schedule of fees should be arrived at by the Optometrical Council in conference with a committee of the Department of Health or the National Health Insurance Board.

In all cases taken care of by an optometrist there should be provided payment to the optometrist from the national health insurance fund. Provision should be provided for those cases where the fixing of a fee is impossible. These types of cases cannot be itemized, are rare in occurrence, but do occur.

Ways and Means:

While the ways and means of financing a Social Security Visual Welfare plan need not be dealt with in this report it behooves us to put some thought to the matter and the optometrical council would submit the following:

A national federal-provincial health insurance plan as recently discussed in the House of Commons and outlined by Pensions Minister MacKenzie and Dr. Marsh would seem to be the basis upon which to finance the plan. Under this plan the provincial security board or health board would draw their needed funds.

Administration of a Social Welfare Visual Welfare Plan:

Administration of a plan of this nature would best be handled as follows:

The lieutenant governor-in-council in conjunction with the Council of Optometry shall establish a central advisory committee and regional advisory committees. These committees shall be responsible to the Department of Health Insurance for the administration of all Optometric services and all that relates to the practice of Optometry under the Act.

Under the Department of Health there shall be a provincial council of Health Insurance representing the Medical, Dental, Optometric, Pharmaceutical and Nursing professions, the hospital council and lay persons representing industry, labour, education and urban organizations.

The Future Expansion of Health Insurance with Respect to Optometry:

Earlier in this report reference was made to the fact that there are only 100 practitioners serving the 630,000 people in this province needing visual care, which as pointed out provides one person to every 6,300 citizens. Obviously, if a social security plan as we have outlined is to

work we must have more optometrists and oculists. What would be a good ratio? An ideal ratio would be one to every 2,500. Assuming that every one of the 630,000 citizens availed themselves of the optometrical services once a year it would be necessary to have 250 practitioners. Experience has shown however that the individual does not visit the optometrist annually and in the light of known facts 200 to 250 optometrists and medical refractionists could safely assume the burden of taking care of the visual welfare of this province.

At present optometry obtains its students from the College of Optometry at the University of Toronto, the College of Optometry, Laval University, Montreal (French speaking) and the various colleges in the United States. However, in order to provide practitioners we would suggest that provision be made for the establishment of an optometric college at the University of Saskatchewan. Such a college would provide optometrists not only for Saskatchewan but may also make men available for the other Western provinces and optometrical associations of those provinces could be asked to contribute to the founding of this college.

Another factor deserving consideration under a Social Security plan is the education of our citizens to the need of good health, good dental care and good visual care. Educational publicity as regards proper sight should be a national and provincial undertaking within the social security plan. Ignorance of the harm and damage one can do to their eyes is the greatest factor optometry has to contend with today.

Finally, when looking to the future we must look to our children. Herein lies our greatest chance to place our country on the highest level of visual attainment. Medicine speaks of preventative medicine; Dentistry speaks of preventative dentistry; and, optometry must speak of preventative optometry. We should above all stress this theme, carry the school clinics to the finish and see to it that the rising generation are fully cared for visually and adequately educated to the care of their eyes.

Conclusion:

It has been a pleasure to meet with your committee and discuss this plan. The magnitude of the task before you is tremendous and the Council of Optometry wishes to tender to you its facilities and members in any undertaking you wish done. Immediate needs strike the mind. An accurate survey needs to be made of this province as to the number of practitioners, their distribution, number of patients served, average costs,

areas unserved, etc. The Saskatchewan Optometric Association would willingly undertake this task if it is so requested. Although industrial establishments are few in this province nevertheless they exist and will increase and accurate visual surveys need to be made similar to those done in the larger eastern centers. Our co-operation is also extended in this respect.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

by J. Fred Andreae, Secretary

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

JOHN F. MORROW, JR.

Dr. John F. Morrow, Jr., well known in the east where he had been a lecturer and instrument demonstrator for American Optical Co., died suddenly in Philadelphia, Pa., on April 1st, on the 37th anniversary of his birth. He was seized with a heart attack.

A native of Philadelphia, Dr. Morrow was graduated from Pennsylvania State College of Optometry and for a time served there as instructor in physiological optics and optometry and assistant chief of clinics. Eight years ago he joined the American Optical Co. and after spending five years in the company's Bureau of Visual Science at Southbridge, Mass., he joined the instrument department of the AO office in New York City. He was a member of The American Academy of Optometry.

Dr. Morrow was married to Miss Katherine Read de Lany in Philadelphia on July 1, 1933. He is survived by an eight-year old son, Mrs. Morrow having died in childbirth.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list, although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

9. HYGIENE AND ILLUMINATION.

LEGIBILITY IN COMIC BOOKS. M. Luckiesh and F. K. Moss. Sight-Saving Review. 1942, 12, 1, 19-24.

From the standpoint of ocular hygiene the authors insist that children's comic books undergo a complete rearrangement to accomplish three things. (1) To increase the size of the reading material offered to children. (2) To remove the frequently dark color contrast backgrounds upon which the reading material is placed, and (3) to materially improve the quality of paper used in these publications. T. O. B.

11. EDUCATION, SOCIOLOGY AND ECONOMICS

ATTEMPTS TO BREAK THE LOCK-STEP. Betts, E. Visual Digest. 1942, 5, 4, 32-44.

The author finds an overemphasis on regimentation in the elementary school system. This has produced a "lock-step" which constitutes a peril in education. Some progress has been made in correcting this condition. The needed steps which should be taken are, (1) classify students by chronological ages rather than by grade groups. (2) Administrative devices contributing to changes in classroom procedures. (3) Secure the approval of teaching staffs in changes of administrative procedure. (4) Remove local organization procedures which handicap the teacher in her individual care of each student. (5) The development of new broad programs which permit of individual care of each student as his or her needs are understood. T. O. B.

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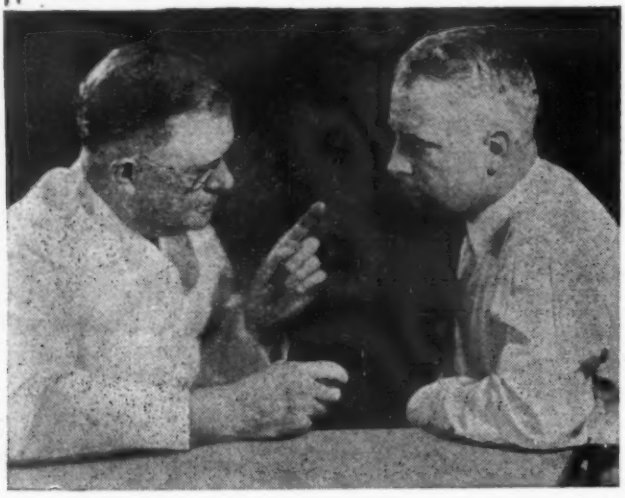

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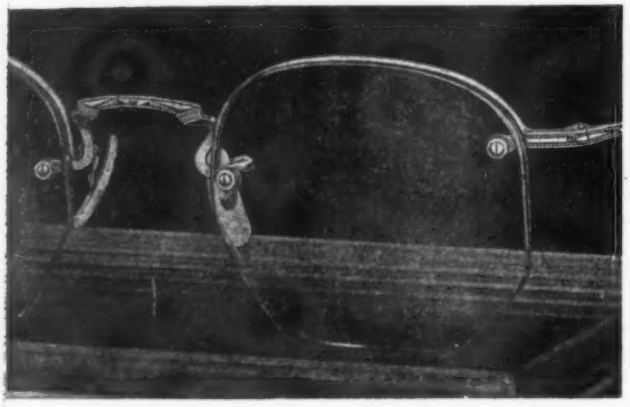

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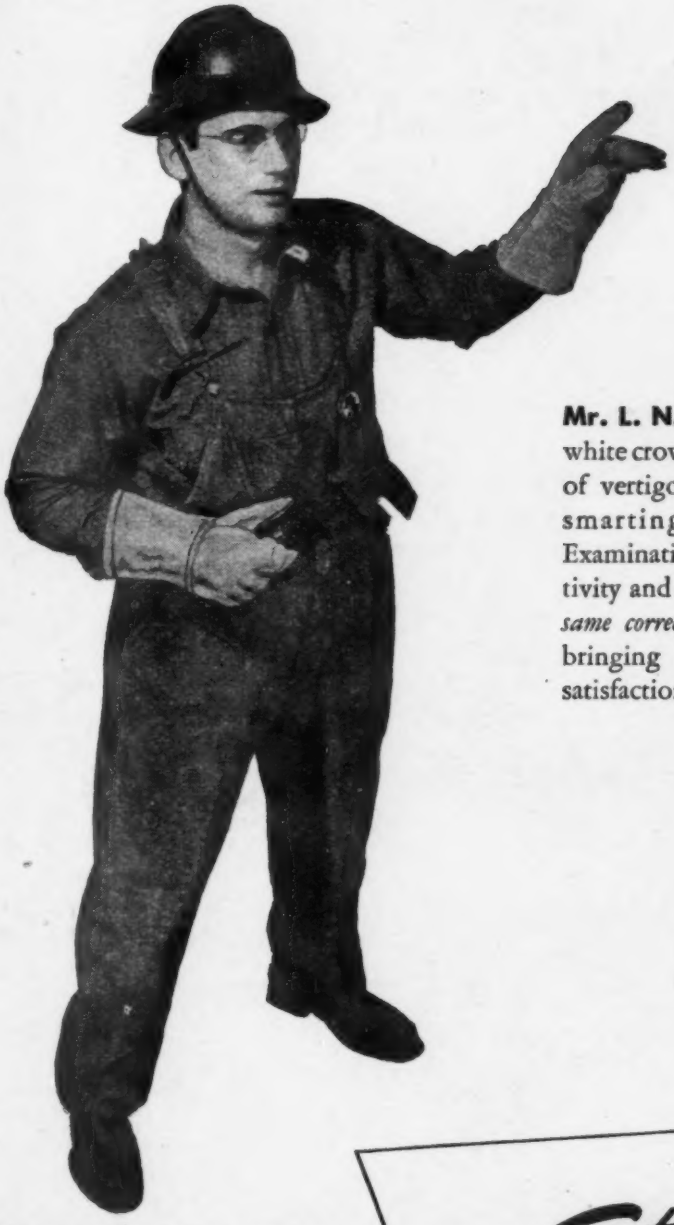

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